

## **CLAIMS**

What is claimed is:

1. An anti-arrhythmia system, comprising:  
a detection circuitry for sensing atrial fibrillation in a heart;  
at least two electrodes for delivering independently controlled stimulus through each electrode, each of the at least two electrodes for attaching to a target atrium; and  
a stimulus generator that can deliver independently controlled stimulus through each of the at least two electrodes in response to sensed atrial fibrillation.
2. The anti-arrhythmia system of claim 1, wherein the detection circuitry can also detect the termination of atrial fibrillation.
3. The anti-arrhythmia system of claim 2, further comprising:  
electronic circuitry for deactivating delivery of stimulus through all of the electrodes when the detection circuitry detects the termination of atrial fibrillation and placing the anti-arrhythmia system in a cardiac pace and suppression mode (Mode III).
4. The anti-arrhythmia system of claim 1, wherein the stimulus generator is configured to permit stimulation to the at least two electrodes concurrently.
5. The anti-arrhythmia system of claim 1, wherein one of the at least two electrodes is both a stimulating electrode and a sensing electrode.

6. The anti-arrhythmia system of claim 1, wherein the stimulus generator can deliver a stimulus that is a train of pulses through at least one electrode.
7. The anti-arrhythmia system of claim 1, wherein each stimulus in the train of pulses is biphasic.
8. An anti-arrhythmia system for suppressing the onset of atrial fibrillation, comprising:
  - electronic circuitry for detecting the cardiac cycle of a target atrium;
  - at least two electrodes, which electrodes are attached to the target atrium; and
  - a stimulus generator having at least two independently controllable stimulation channel outputs,
  - wherein the electronic circuitry for detecting the cardiac cycle is responsive to atrial contraction and is in communication with the stimulus generator that can deliver timed stimulation through each of the at least two electrodes to suppress the onset of atrial fibrillation.
9. The anti-arrhythmia system of claim 8, wherein the stimulus generator is configured to deliver stimuli,  $S_1$ ,  $S_2$  ...  $S_N$ , concurrently to N number of electrodes, where N is 2 or greater, such that occurrence of  $S_1$  and  $S_2$  either completely or partially overlap in a time duration,  $S_2$  and  $S_3$  either completely or partially overlap in a time duration, and so on, such that  $S_{N-1}$  and  $S_N$  either completely or partially overlap in a time duration.
10. The anti-arrhythmia system of claim 9, wherein at least one of the stimulus delivered at one electrode is a train of pulses.

11. A method for detecting the onset of atrial fibrillation and stopping atrial fibrillation comprising:

attaching at least two electrodes on one atrium;

detecting atrial fibrillation;

delivering a constant-current, but independently settable stimulus through each of the at least two electrodes to stop the atrial fibrillation;

detecting the cessation of atrial fibrillation; and

deactivating the delivery of stimulus to each of the at least two electrode, in response to the cessation of atrial fibrillation.

12. The method of claim 11, wherein the step of delivering a constant-current, but independently settable stimulus through each of the at least two electrodes is accomplished through sequential delivery of stimulus through each of the at least two electrodes.

13. The method of claim 12, wherein at least one stimulus is a train of pulses.

14. The method of claim 11, wherein the step of delivering a constant-current, but independently settable stimulus for the at least two electrodes is performed by delivering stimulus through the at least two electrodes in a timed sequence.

15. The method of claim 11, wherein detecting atrial fibrillation is performed by using one of the at least two electrodes as a sense electrode.

16. A method of suppressing the initiation of atrial fibrillation, the method comprising:
- attaching at least two electrodes on a target atrium;
  - detecting the onset of atrial contraction at the target atrium using a sense electrode; and
  - delivering, constant-current, but independently settable stimulus through each of the at least two electrodes to suppress the initiation of atrial fibrillation in the target atrium.
17. The method of claim 16, wherein the delivery of stimulus through the at least two electrodes is in a timed sequence.
18. The method of claim 16, wherein the stimulus generator can provide a stimulus at each channel that is a train of pulses.
19. The method of claim 16, wherein the step of detecting the onset of atrial contraction is performed by using one of the at least two electrodes as a sense electrode.
20. A method for both pacing the atrium and suppressing the initiation of atrial fibrillation, the method comprising;
- providing at least two electrodes attached to a target atrium for independently delivering stimulus through the at least two electrodes
  - sensing cardiac activity using a sense electrode to determine when the atrium should be paced; and
  - delivering a timed sequence of stimulus pulses through each of the at least two electrodes to contract the atrium,

wherein the resulting atrial contraction is completed faster than the atrium's native contraction, thereby forestalling initiation of conduction circus motions.

21. The method of claim 20, wherein the stimulus provided at each electrode is at least one current-controlled pulse.

22. The method of claim 21, wherein the stimulus provided at one electrode is a train of pulses.